Hippocampal Modulation of Associative Learning
Grant number N00014-91-J-1764
ANNUAL PROGRESS REPORT 1992

The Columbia College research team is working on several projects connected to the main proposal. The team is lead by Dr. Zafra Lerman, Head, Institute for Science Education and Science Communication and Dr. Geof Goldbogen, Chairman, Academic Computing.

Much of our research is derived from visits to Dr. Nestor Schmajuk's laboratory at Northwestern University and review of his maze-based spatial learning and cognitive mapping experiments. Some of his spatial learning experiments are based on interactive computer display of a problem to be solved.

Our collaboration and interaction with Dr. Schmajuk at Northwestern University suggested two lines of scientific inquiry:

1) How changing visual information on the computer — from abstract to more realistic — affects spatial learning;

2) Does the performance of "right-brain" oriented people differ from that of "left-brain" oriented people (artistic vs. analytic)?

We were motivated to address the first question after observing that the graphics presentation in Dr. Schmajuk's spatial learning experiments included simplistic wire frame mazes. Our research addressed the issues of:

- How realistic could these mazes be made using personal computers?
- How much effort is required to improve the reality of these mazes?
- How does the improved visual presentation improve the spatial learning?

We have reached the point in our research where we can build virtual reality mazes and study how this affects spatial learning.

This research is being performed by Columbia College students David Morton and Michael Wallisky; results were submitted for presentation in the Third Annual Argonne Symposium for Undergraduates in Science, Engineering and Mathematics.
Preliminary tests revealed that artistic-oriented students perform the visual problem solving (hence spatial learning) better than analytic-oriented students. These preliminary results raised the question of any difference in performance between innercity students and suburban students. We are now in the stage of finishing preparation of the tests in order to begin testing hundreds of students to establish a data baseline for these observations.

PUBLICATIONS:


Nestor Schmajuk is working on several projects connected to the main proposal.

In collaboration with Northwestern student James J. DiCarlo, Nestor Schmajuk developed a model of stimulus configuration, classical conditioning, and the hippocampus (Schmajuk and DiCarlo, 1992; communications to two international and two national conferences), that uses a biologically plausible version of backpropagation.

In collaboration with Northwestern student Beth A. Christiansen, Nestor Schmajuk is studying the effect of hippocampal lesions on latent inhibition using the rat eyeblink preparation as described by Schmajuk and Christiansen (1990). This line of research has generated one communication to a scientific meeting (Christiansen and Schmajuk, 1991), a paper in press (Christiansen and Schmajuk, 1992), and a paper in preparation (Schmajuk, Lam, and Christiansen, in preparation).

In collaboration with Professor Jeffrey Gray (Oxford University, University of London), Nestor Schmajuk is developing a model of latent inhibition (Schmajuk and Gray, in preparation).

In collaboration with Northwestern students Hugh T. Blair and Aaron Thieme, Nestor Schmajuk is working on neural models of hippocampal participation in spatial learning and cognitive mapping (Schmajuk and Thieme, 1992; Schmajuk, Thieme, and Blair, submitted; Schmajuk and Blair, submitted).

In collaboration with Northwestern student David Urry, Nestor Schmajuk developed a neural network model of avoidance. Results of this project will be presented at the meeting of the Psychonomic Society and have been submitted for publication (Schmajuk and Urry, submitted).

In collaboration with Drs. Bruce Perry and Daniel Luchins (University of Chicago), Nestor Schmajuk is studying the effect of hippocampal lesions on dopamine receptors in Nucleus Accumbens and frontal cortex (Perry, Luchins, and Schmajuk, submitted).

In collaboration with Dr. Barry Peterson (Northwestern University), Nestor Schmajuk is modeling plastic mechanisms of the vestibulo-ocular reflex (Quinn, Schmajuk, Baker, and Peterson, 1992; Quinn, Schmajuk, Jain, Baker, and Peterson, 1992).
Nestor A. Schmajuk
1992

Graduate student funded: Hugh T. Blair

PAPERS PUBLISHED


PAPERS IN PRESS
5. Schmajuk, N.A. and Christiansen, B.A. Hippocampectomy disrupts the topography of the rat eyeblink conditioned response during acquisition and extinction of classical conditioning. Brain Research, in press.


PAPERS SUBMITTED


PAPERS IN PREPARATION

COMMUNICATIONS TO SCIENTIFIC MEETINGS


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5. Schmajuk, N.A. and Christiansen, B.A. Hippocampectomy disrupts the topography of the rat eyeblink conditioned response during acquisition and extinction of classical conditioning. Brain Research, in press.


PAPERS SUBMITTED
7. Schmajuk, N.A., Thieme, A.D., and Blair, H.T. Role of the hippocampus in spatial learning and cognitive mapping: A neural network approach. hippocampus.


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